IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

DAVID L. LARKIN ET AL.

Serial No. 09/988,651 (TI-23422.1)

Filed November 20, 2001

For: A METHOD FOR DECREASING CHC DEGRADATION

Art Unit 2891

Examiner Igwe U. Anya

Customer No. 23494

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF MAILING OR TRANSMISSION UNDER 37 CFR 1.8

I hereby certify that the attached document is being deposited with the United States Postal Service with sufficient postage for First Class Mail in an envelope addressed to Director of the United States Patent and Trademark Office, P.O. Box 1450,, Alexandria, VA 22313-1450 or is being facsimile transmitted on the date indicated below:

5-22-07

Jay M. Cantor, Reg. No. 19,906

Sir:

BRIEF ON APPEAL

REAL PARTY IN INTEREST

The real party in interest is Texas Instruments Incorporated, a Delaware corporation with offices at 7839 Churchill Way, Dallas, Texas 75251. A chemical Board is requested since the invention herein is directed to matters of chemistry rather than electronics.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals and/or interferences.

STATUS OF CLAIMS

This is an appeal of claims 12 to 29, all of the rejected claims. Claims 1 to 11, which are the subject of Patent No. 6,350,673, have been canceled and claims 15 to 19 and 24 to 28 were previously indicated to be allowable if rewritten in independent form and are now rejected. No fee is believed to be required since a fee for a Brief on Appeal was previously filed. However, should a fee be required, please charge any costs to Deposit Account No. 20-0668.

STATUS OF AMENDMENTS

An amendment was not filed after a second or final rejection and not entered.

SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention relates to a method of decreasing channel hot carrier (CHC) degradation in semiconductor devices. This problem is minimized in accordance with the present invention, as stated in claim 12, by (a) providing a semiconductor device manufactured using the process of providing a semiconductor device having at least one metal layer completed (40, page 9, line 1ff), (b) then applying a planarizing dielectric layer on top of the semiconductor device and the metal layer (42, 44, 48, page 9, line 1ff) and (c) then providing a hydrogen treatment until hydrogen diffuses throughout and substantially saturates the semiconductor device (50, page 9, line 1ff).

The hydrogen treatment can include heating the semiconductor device in a hydrogen rich environment or applying hydrogen in situ by introducing hydrogen as a plasma to the semiconductor device. The semiconductor device can undergo the hydrogen treatment after a final layer of the planarizing dielectric layer is added.

In accordance with claim 21, the semiconductor device is manufactured by (a) providing a semiconductor device having thereon at least one metal layer completed (40, page 9, line 1ff) and (b) then providing a hydrogen treatment until hydrogen diffuses throughout and substantially saturates the semiconductor device (50, page 9, line 1ff). The hydrogen treatment can include heating the semiconductor device in a hydrogen environment or applying hydrogen in situ by introducing hydrogen as a plasma to the semiconductor device.

GROUNDS OF REJECTION

Claims 21 to 29 were rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 12 to 29 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

Claim 12 to 14, 20, 21 to 23 and 29 were rejected under 35 U.S.C. 102(e) as being anticipated by Ino et al. (U.S. 5,888,839).

Claims 21 to 23 were rejected under 35 U.S.C. 102(b) as being anticipated by Mora (U.S. 4,920,077).

Claims 12 to 14, 19 to 23, 28 and 29 were rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. (U.S. 5,866,945).

Claims 15 to 18 and 24 to 27 were rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al.

ARGUMENT

Claims 21 to 29 were rejected under 35 U.S.C. 112, first paragraph, on the ground that the limitation "substantially saturates" in line 7 of claim 12 and line 8 of claim 21 constitutes new matter. The rejection is clearly without merit. It is well known and the Courts have consistently held that the term "substantially" or "substantial" can be used as long as any deviation in inconsequential. In the present case, saturation may not be 100%, however a saturation which very closely approaches 100% and provides the results as claimed is still covered by the invention and that is what is being claimed. In the present case, since there are millions if not billions of bond sites available for saturation, it is possible and likely that an insignificant number of such sites may not become saturated. This is in no way an alteration of the invention as claimed. The Court stated "The word substantial, however, requires only that the crystalline content not be inconsequential" citing Standard Oil et al. v. Montedison et al. S.p.A., 206 U.S.P.Q. 676 at 714. If follows that there is no new matter in the claims as presented. Se also the paragraph immediately below which is incorporated herein by reference.

Claims 12 to 29 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite. The rejection is without merit. In this regard, reference is made to M.P.E.P. 2173(b) D wherein the term "substantially" is stated by Court decision not to be indefinite. Furthermore, it is not indefinite in the sense used in the present claims. The intent is to totally saturate the device with hydrogen. However, it is possible and probably likely to a very small and insignificant number of sites may be unsaturated without in any way altering the invention herein. Such devices are also covered by the invention herein and the term "substantially" is used to cover such devices. It is therefore readily apparent that not only does simple logic dictate

that the claims are definite, but, in addition, the case law, the MPEP, common sense and file wrapper estoppel also dictate the scope of the claims herein.

Claim 12 to 14, 20, 21 to 23 and 29 were rejected under 35 U.S.C. 102(b) as being anticipated by Ino et al. (U.S. 5,888,839). The rejection is without merit.

Claim 12 requires, among other features, the steps of applying a planarizing dielectric layer on top of the semiconductor device and the metal layer; and then providing a hydrogen treatment until hydrogen diffuses throughout *and substantially saturates the semiconductor device*. No such steps are taught or even remotely suggested by Ino et al. Ino et al. provide the hydrogen for an entirely different purpose and, more importantly, do not diffuse the hydrogen throughout and substantially saturate the semiconductor device. The treatment in accordance with the present invention will either pacify any dangling bonds in the semiconductor device to prevent damage to the gate oxide layer or cause the hydrogen to bond with contaminants, thereby making the contaminant too large to diffuse through the semiconductor device. No such treatment is taught or even remotely suggested by Ino et al. There is clearly no teaching or suggestion in Ino et al. to saturate the semiconductor device with hydrogen. The use of the term "substantially" is treated above and any discussion thereon is incorporated herein by reference.

The above features are also found in claim 21. In addition, claims 13, 14, 20 to 23 and 29 depend from one of claims 12 and 21 and therefore define patentably over Ino et al. for at least the reasons presented above with reference to claim 12.

Claims 21 to 23 were rejected under 35 U.S.C. 102(b) as being anticipated by Mora (U.S. 4,920,077). The rejection is without merit.

With reference to claims 12 and 21, the argument presented above with reference to Ino et al. applies as well in this case and is incorporated by reference.

The examiner refers to column 4, lines 48-54 of Mora for heating in a hydrogen-rich atmosphere. Mora fails for at least two reasons. The first, as stated above, is that there is no teaching or suggestion that hydrogen is used to *substantially saturate* the device as required and there is no saturation for the purpose of decreasing CHC degradation. Furthermore, the material used is not hydrogen, but rather silane which is silicon tetrahydride (a silicon atom with four hydrogen atoms attached thereto), not hydrogen. When silane is broken up, not only does it release hydrogen, but it also releases silicon which could be a contaminant and an undesirable byproduct. The use of the term "substantially" is treated above and the discussion thereon is incorporated herein by reference.

Claims 22 and 23 depend from claim 21 and therefore define patentably over Mora for at least the reasons presented above with reference to claims 12 and 21.

Claims 12 to 14, 19 to 23, 28 and 29 were rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. (U.S. 5,866,945). The rejection is without merit.

A simple reading of the disclosure of Chen et al. will indicate that it has nothing whatsoever to do with the invention herein. Any person with a knowledge of elementary chemistry will realize that the Si-H bond referred to is a bond on the HSQ and not on a semiconductor. HSQ is a dielectric which is also referred to as such in the subject application. There is no way in which Chen et al teaches or even remotely suggests saturation of the semiconductor device with hydrogen.

Claims 15 to 18 and 24 to 27 were rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. The rejection is without merit for the reasons presented in the paragraph immediately above.

CONCLUSIONS

For the reasons stated above, reversal of the final rejection and allowance of the claims on appeal is requested that justice be done in the premises.

Respectfully submitted,

Jay M. Cantor
Reg. No. 19906
(301) 424-0355
(972) 917-5293

CLAIMS APPENDIX

The claims on appeal read as follows:

12. A semiconductor device manufactured using the following process:

providing a semiconductor device having at least one metal layer completed;

then applying a planarizing dielectric layer on top of the semiconductor device and the metal layer; and

then providing a hydrogen treatment until hydrogen diffuses throughout and substantially saturates the semiconductor device.

13. The semiconductor device of Claim 12, wherein the hydrogen treatment includes heating the semiconductor device in a hydrogen rich environment.

14. The semiconductor device of Claim 12, wherein the hydrogen treatment includes applying hydrogen in situ by introducing hydrogen as a plasma to the semiconductor device.

15. The semiconductor device of Claim 12, wherein the planarizing dielectric layer includes a first layer of TEOS, a second layer of HSQ, and a third layer of TEOS.

16. The semiconductor device of Claim 12, wherein the planarizing dielectric layer includes a first layer of TEOS applied by PECVD.

17. The semiconductor device of Claim 12, wherein the planarizing dielectric layer includes a second layer of HSQ applied by coating applied over a first layer of dielectric material.

18. The semiconductor device of Claim 12, wherein the planarizing dielectric layer includes a third layer of TEOS applied by PECVD applied over two layers of dielectric material.

19. The semiconductor device of Claim 12, wherein the semiconductor device undergoes an N_2 bake after an HSQ of a multilayer planarizing dielectric layer is added.

20. The semiconductor device of Claim 12, wherein the semiconductor device undergoes the hydrogen treatment after a final layer of the planarizing dielectric layer is added.

21. A semiconductor device manufactured using the following process:

providing a semiconductor device having thereon at least one metal layer completed; and

then providing a hydrogen treatment until hydrogen diffuses throughout and substantially saturates the semiconductor device.

22. The semiconductor device of Claim 21 wherein the hydrogen treatment includes heating the semiconductor device in a hydrogen environment.

23. The semiconductor device of Claim 21, wherein the hydrogen treatment includes applying hydrogen in situ by introducing hydrogen as a plasma to the semiconductor device.

24. The semiconductor device of Claim 21, further including a planarizing dielectric on said semiconductor device and said metal layer wherein the planarizing dielectric layer includes a first layer of TEOS, a second layer of HSQ, and a third layer of TEOS.

25. The semiconductor device of Claim 21, further including a planarizing dielectric on said semiconductor device and said metal layer wherein the planarizing dielectric layer includes a first layer of TEOS applied by PECVD.

26. The semiconductor device of Claim 21, further including a planarizing dielectric on said semiconductor device and said metal layer wherein the planarizing dielectric layer includes a second layer of HSQ applied by coating applied over a first layer of dielectric material.

27. The semiconductor device of Claim 21, wherein the planarizing dielectric layer includes a third layer of TEOS applied by PECVD applied over two layers of dielectric material.

28. The semiconductor device of Claim 21, wherein the semiconductor device undergoes an N_2 bake after an HSQ of a multilayer planarizing dielectric layer is added.

29. The semiconductor device of Claim 21, wherein the semiconductor device undergoes the hydrogen treatment after a final layer of the planarizing dielectric layer is added.

EVIDENCE APPENDIX

Not applicable

RELATED PROCEEDINGS APPENDIX

Not applicable